

Global leadership in science and innovation alive and well in the San Francisco Bay Area

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The San Francisco Bay Area is renowned as the centre of the high-tech world. It dominates established tech industries like computer hardware and software, as well as more recent fields like biotech. How well is the Bay Area keeping pace in the latest areas of innovation?

Silicon Valley, located just South of the City of San Francisco, began its rise to dominance in the IT sector in the early 20th century. It was here where Stanford University graduates William Hewlett and Dave Packard applied their grit and genius, and grew their company out of a modest garage in 1934 into today's computer giant Hewlett-Packard. Over the past three decades, the SF Bay Area has continued to be a leader in innovation and turned itself into a hub for biotech. It is home to the world's largest concentration of biotech companies (more than 600), including biotech pioneers such as Genentech, Chiron (now part of Novartis) and Gilead Sciences. The area's newest endeavour is the blossoming clean-tech industry which benefits from the blend of silicon and life science-based and entrepreneurial talents in the area.

A large part of the Bay Area's innovative spirit stems from the **world class research and education institutions** that call the area home, including Stanford University, the University of California at Berkeley, and the University of California San Francisco (UCSF, one of the US' leading medical institutes). The three schools have garnered 54 Nobel prizes between them, received a total of \$2 billion in R&D funding in 2007, and produced some of the brightest scientific and technical minds, including the founders of Google, Yahoo!, Cisco, Apple, Sun Microsystems, Intel and Genentech. Both Berkeley and Stanford rank at or near the top of universities worldwide for excellence in the science and arts in 2007 (Times Higher Education Supplement). The Bay Area is also home to the Lawrence Berkeley National Laboratory which was key in the development of nuclear technology in the 1940's. The lab is now heavily dedicated to research into biology,



The Golden Gate Bridge - gateway to tech heaven

genetics, nanotechnology, and alternative energy.

The Bay Area's entrepreneurial spirit is fed by its **strong venture capital (VC) community**. Within the US, the area remains the most desirable place for VC financiers, who poured close to \$10 billion into the local economy in 2007 – about one third of total US financing. Sand Hill Road, near Stanford University, has become to private equity what Wall Street is to the stock market. This triangle of research institutions, commercial spirit and venture capital has created the Bay Area's exceptionally vibrant and diverse science community.

Scientific innovation is enhanced further by generous **private and philanthropic funding**, including several major foundations set up by Silicon Valley entrepreneurs. Major gifts in 2007 included a \$200 million commitment from the San Francisco-based Gordon and Betty Moore Foundation (co-founder of Intel) to the University of California for a telescope, and a \$150 million donation from an anonymous Bay Area donor to the UCSF Cancer Centre for cancer research. The private sector is also directly involved in an impressive range of research based programmes targeting international development problems eg in global health. These include non-profit and for-profit endeavours which draw on the scientific excellence of Bay Area institutions. In December 2007, the

FCO Science & Innovation team in San Francisco brought together leaders and scientists from a number of such organisations, including the Gates Foundation Global Health programme, to explore the potential for stronger international collaboration in global health research and development. Follow up discussions are planned for Spring 2008 when the FCO Science and Innovation team will bring a delegation of West Coast global health experts to the UK.

A Stem Cell Revolution in California

California has become a new hub for stem cell research, drawing researchers and companies to the state. Among them is Shinya Yamanaka from Japan, who shot to stardom in 2007 after publishing his success in reprogramming ordinary skin cells into stem cells. Dr Yamanaka recently opened a lab at the Gladstone Institutes, San Francisco.

California's rapid rise as a centre of stem cell technology is a response to the federal ban on most human embryonic stem cell research. Three years after President Bush's 2001 clamp down on embryonic stem cell research, California voters passed a law creating the California Institute for Regenerative Medicine (CIRM). The institute is housed in San Francisco and will disburse \$3 billion of public funds for stem cell research over 10 years. To date, \$260 million have been

allocated, nearly 30% of which will go to laboratories at Stanford University and UCSF. California's bold initiative is now being copied by many other states, including Connecticut and Massachusetts.

The FCO Science & Innovation team in San Francisco has been engaged in promoting co-operation of UK and California stem cell policy makers and researchers. Building bridges, including through a new FCO Collaboration Development Award programme between the fast growing California stem cell research community and the UK's strong research base in this field is paving the way for extensive collaboration. Ultimately, this will accelerate stem cell science in both countries and speed the development of cures for disease.

The S&I team assisted a collaboration between Newcastle University researchers and Shoukhrat Mitalipov's high-profile research group in Oregon – the first to successfully derive stem cells from monkey embryos.

Getting paid to be the steward of the earth

California has taken an important lead in addressing the challenge of climate change including through ground breaking legislation mandating economy wide greenhouse gas emission reductions (equivalent to 25% economy wide reduction in emissions by 2020). The need to reverse the US "addiction" to oil has become a major focus of the science and innovation effort.

The San Francisco Bay Area, true to its environmentalist traditions, is leading the clean-tech revolution through a remarkable combination of public and private sector initiatives. In the public realm, three of the most recent major initiatives dedicated to alternative energy have been clustered around Berkeley. BP established the Energy Biosciences Institute at UC Berkeley with a \$500 million endowment for research into sustainable fuels. Further up the hill at Lawrence Berkeley National Lab, two projects are using government

funding to spur development of solar technology and biofuels. There are also exciting research initiatives taking place at Stanford University, eg the Global Climate and Energy Programme (GCEP) supported by around \$250 million from the private sector.

Perhaps the best indication of just how significant clean-tech is in the tech economy is VC funding. Clean-tech funding from US venture capitalists has risen to over \$2.5 billion in the first 9 months of 2007, up 50% from the previous year. \$730 million went to California firms. The three biggest clean-tech investors – Khosla Ventures, Draper Fisher Jurvetson, and Kleiner Perkins Caufield & Byers – are all headquartered in the Bay Area. Al Gore, champion of the environmental movement, recently joined Kleiner Perkins to push forward clean-tech investments. Indicative of the clean-tech boom, the solar panel manufacturer SunPower was the fastest to grow among the Bay Area's top 200 companies in 2007 (since going public two years ago, SunPower's stock price has increased by about 450%). The company's founder, Dr Richard Swanson, developed SunPower's solar technology with his students while he was Professor of Electrical Engineering at Stanford University, completing yet another Bay Area university – company – VC circle.

In 2006 then Prime Minister Tony Blair and Governor Arnold Schwarzenegger established UK-California collaboration on climate change and clean energy. This has led to a busy two-way flow of information, ideas and expert visits, co-ordinated by the FCO Science and Innovation team. Activities in the last year have included discussions between Sir Nicholas Stern and California experts on climate change economics, between the King review team and California experts on low carbon transport, and a best practice exchange on sustainable energy options between local government leaders from London, Woking and Southampton and Western USA cities. The collaboration is still going strong and ranges from climate change communication to clean technology.

With so much talent, dynamism and research funding, the Bay Area will continue to be an important partner region for the UK and a focus of activity for the FCO Science and Innovation network, particularly in the areas of stem cell research, clean tech, science for development and wider innovation.

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Silicon Valley's Google campus, the Googleplex. The internet giant uses massive amounts of electricity to power and cool its data centres. The company installed solar panels on its rooftops in 2007, projected to "produce enough electricity for approximately 1,000 California homes or 30 per cent of Google's peak electricity demand in our solar powered buildings", Google reports.